

REMARKSClaim Rejections – 35 U.S.C. §103

Claims 1, 13, 16, 23, and 29 stand rejected under 35 U.S.C. §103(a) as being unpatentable over McCollum (US 5,789,764) in view of Takagi et al. (US 5,550,400) and Shan et al. (US 6,906,421).

For a §103 obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. MPEP 2143.

Claim 1 recites a reprogrammable metal-to-metal antifuse comprising “... a lower adhesion-promoting layer disposed over said lower Ti barrier layer; an antifuse material layer disposed above an upper surface of said lower adhesion-promoting layer, said antifuse material layer selected from a group comprising at least one of amorphous carbon and amorphous carbon doped with at least one of hydrogen and fluorine disposed over said lower adhesion-promoting layer; an upper adhesion-promoting layer disposed over said antifuse material layer ... wherein said lower adhesion-promoting layer and said upper adhesion-promoting layer each have a thickness of between about 2 angstroms and about 20 angstroms.”

Neither McCollum nor Takagi discloses lower and upper adhesion-promoting layers each having a thickness of between about 2 angstroms and about 20 angstroms as recited in Claim 1. Examiner argues that Shan teaches adhesion-promoting layers

having a thickness of between about 10 angstroms and about 200 angstroms and that it would have been obvious to a person of ordinarily skill in the art to use the lower adhesion-promoting layer and the upper adhesion-promoting layer each with a thickness of between about 2 angstroms and about 20 angstroms in McCollum's device in order to reduce the size of the device.

However, Applicant respectfully disagrees with Examiner's assertion. A factor cutting against a finding of motivation to modify the prior art is when the prior art teaches away from the claimed modification. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that the applicant took. See *In re Gurley*, 31 USPQ 2d 1130 (Fed. Cir. 1994). Examiner cites barrier metal layers 90 and 94 in McCollum as the lower and upper adhesion promoting layers of Claim 1. However, McCollum teaches that the "barrier layer thicknesses are typically 2,000 angstroms thick, since their purpose is to prevent aluminum or other metals from the conductors from diffusing into the antifuse material layer." (Col. 12, lines 25-30). In this respect, McCollum actually teaches away from the minimization of the adhesion-promoting layers proposed by Examiner, as it stresses the importance of a thickness well outside the claimed "between about 2 angstroms and about 20 angstroms" range.

Since McCollum teaches away from the proposed modification, Applicants respectfully submit that Examiner has failed to establish that the prior art contains some suggestion or incentive that would have motivated the skilled artisan to modify the prior art as suggested by Examiner. Therefore, Applicants respectfully submit that Claim 1 is non-obvious and patentable over McCollum in view of Takagi and Shan.

Since Claims 13 and 16 depend from Claim 1, Applicants respectfully submit that Claims 13 and 16 are also patentable as they contain the same limitations as Claim 1.

Applicants respectfully submit that the same arguments made above with respect to the patentability of Claim 1 are applicable to the patentability of Claim 23 as well.

Since Claim 29 depends from Claim 23, Applicants respectfully submit that Claim 29 is also patentable as it contains the same limitations as Claim 23.

Therefore, Applicants respectfully submit that Claims 1, 13, 16, 23, and 29 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 14-15 and 30-31 stand rejected under 35 U.S.C. §103(a) as being unpatentable over McCollum, Takagi and Shan, and further in view of Liu et al. ("A New Metal-to-Metal Antifuse with Amorphous Carbon," IEEE Electron Device Letters, Vol. 19, No. 9, (1998), pp. 317-319).

Since Claims 14-15 depend from Claim 1, Applicants respectfully submit that Claims 14-15 are also patentable as they contain the same limitations as Claim 1.

Since Claims 30-31 depend from Claim 23, Applicants respectfully submit that Claims 30-31 are also patentable as they contain the same limitations as Claim 23.

Therefore, Applicants respectfully submit that Claims 14-15 and 30-31 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 1, 3, 6-8, 11-17, 20-22, 29, and 34 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forouhi (US 5,181,096) in view of Liu and Shan.

Claim 1 recites a reprogrammable metal-to-metal antifuse comprising "... a lower adhesion-promoting layer disposed over said lower Ti barrier layer; an antifuse material layer disposed above an upper surface of said lower adhesion-promoting layer, said antifuse material layer selected from a group comprising at least one of amorphous carbon and amorphous carbon doped with at least one of hydrogen and fluorine disposed over said lower adhesion-promoting layer; an upper adhesion-promoting layer disposed over said antifuse material layer ... wherein said lower adhesion-promoting layer and said upper adhesion-promoting layer each have a thickness of between about 2 angstroms and about 20 angstroms."

Neither Forouhi nor Liu discloses lower and upper adhesion-promoting layers each having a thickness of between about 2 angstroms and about 20 angstroms as recited in Claim 1. Examiner argues that Shan teaches adhesion-promoting layers having a thickness of between about 10 angstroms and about 200 angstroms and that it would have been obvious to a person of ordinarily skill in the art to use the lower adhesion-promoting layer and the upper adhesion-promoting layer each with a thickness of between about 2 angstroms and about 20 angstroms in Forouhi's device (Examiner's recitation of "McCollum's device" in the second line of Page 6 of the Office Action appears to be a mistake) in order to reduce the size of the device.

However, Applicant respectfully disagrees with Examiner's assertion. A factor cutting against a finding of motivation to modify the prior art is when the prior art teaches away from the claimed modification. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that the applicant took. See *In re Gurley*, 31 USPQ 2d 1130 (Fed. Cir. 1994). Examiner cites first and second dielectric layers 20 and 24 in Forouhi as the lower and

upper adhesion promoting layers of Claim 1. However, Forouhi teaches a dielectric layer thickness in the range of between about 50 to 300 angstroms. (Col. 5, lines 3-10). In this respect, Forouhi actually teaches away from the minimization of the adhesion-promoting layers proposed by Examiner, as it stresses the importance of a thickness well outside the claimed “between about 2 angstroms and about 20 angstroms” range.

Since Forouhi teaches away from the proposed modification, Applicants respectfully submit that Examiner has failed to establish that the prior art contains some suggestion or incentive that would have motivated the skilled artisan to modify the prior art as suggested by Examiner. Therefore, Applicants respectfully submit that Claim 1 is non-obvious and patentable over Forouhi in view of Liu and Shan.

Since Claims 3, 6-8, 11-17, and 20-22 depend from Claim 1, Applicants respectfully submit that Claims 3, 6-8, 11-17, and 20-22 are also patentable as they contain the same limitations as Claim 1.

Since Claims 29 depends from Claim 23, Applicants respectfully submit that Claim 29 is also patentable as it contains the same limitations as Claim 23.

Applicants respectfully submit that the same arguments made above with respect to the patentability of Claim 1 are applicable to the patentability of Claim 34 as well.

Therefore, Applicants respectfully submit that Claims 1, 3, 6-8, 11-17, 20-22, 29 and 34 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 23-24 and 27-32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forouhi, Liu and Shan, and further in view of McCollum.

Applicants respectfully submit that the same arguments made above with respect to the patentability of Claim 1 are applicable to the patentability of Claim 23 as well.

Since Claims 24 and 27-32 depend from Claim 23, Applicant respectfully submits that Claims 24 and 27-32 are also patentable as they contain the same limitations as Claim 23.

Therefore, Applicants respectfully submit that Claims 23-24 and 27-32 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 4-5, 9-10, 18-19, and 33 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forouhi, Liu and Shan, and further in view of Han (US 6,583,953).

Since Claims 4-5, 9-10 and 18-19 depend from Claim 1, Applicants respectfully submit that Claims 4-5, 9-10 and 18-19 are also patentable as they contain the same limitations as Claim 1.

Applicants respectfully submit that the same arguments made above with respect to the patentability of Claim 1 are applicable to the patentability of Claim 33 as well.

Therefore, Applicants respectfully submit that Claims 4-5, 9-10, 18-19, and 33 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 25-26 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forouhi, Liu, McCollum, and Shan, and further in view of Han.

Since Claims 25-26 depend from Claim 23, Applicants respectfully submit that Claims 25-26 are also patentable as they contain the same limitations as Claim 23.

Therefore, Applicants respectfully submits that Claims 25-26 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 40 and 42-46 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Forbes (US 6,674,667).

Claim 40 recites a method for programming and erasing a reprogrammable metal-to-metal antifuse, comprising “programming said antifuse … erasing said antifuse … and reprogramming said antifuse by applying a programming potential across said antifuse to cause a programming current to flow through said antifuse until its resistance substantially decreases if said erasing step is successful, wherein said erasing step is successful if said antifuse has been returned to a high-resistance state.”

Applicants respectfully submit that the cited prior art does not disclose, nor does it render obvious reprogramming the antifuse by applying a programming potential across the antifuse to cause a programming current to flow through the antifuse until its resistance substantially decreases if the erasing step is successful, wherein the erasing step is successful if the antifuse has been returned to a high-resistance state.

Examiner admits that Forbes does not teach that reprogramming the antifuse occurs after the erasing step is successful, but argues that it would have been obvious to one of ordinary skill in the art to reprogram Forbe’s antifuse after the erasing step is successful in order to obtain the correct information when reprogramming. However, Examiner has failed to provided any evidence of this claim limitation being disclosed in the prior art. Furthermore, Examiner has failed to cite any suggestion or incentive disclosed in the prior art that would motivate one skilled in the art to modify Forbes to include this limitation. Merely stating that such a modification would be obvious without providing any evidence for this assertion is insufficient to uphold the obviousness rejection. As stated in MPEP 2144.03(A), it “is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record, as the

principal evidence upon which a rejection was based.” Broad conclusory statements standing alone are not evidence. MPEP 2144.03(C). Applicants respectfully request that Examiner provide evidence in the prior art of a disclosure and a motivation for this claim limitation , or otherwise withdraw the rejection.

Since Claims 42-46 depend from Claim 40, Applicants respectfully submit that Claims 42-46 are also patentable as they contain the same limitations as Claim 40.

Therefore, Applicants respectfully submit that Claims 40 and 42-46 are currently in condition for allowance. Reconsideration and withdrawal of the rejection is respectfully requested.

Respectfully submitted,
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Dated: April 4, 2007

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